

I claim:

1. A low-boron, high-barium concentration glass fiber composition comprising:

less than about 1 weight percent boron;

5 from about 5.5 to about 18 weight percent barium oxide;

from about 10 to about 14.5 weight percent alkali oxide;

from about 4 to about 8 weight percent alumina;

from about 1 to about 9 weight percent alkaline earth oxide,

excluding barium oxide;

10 from about 2 to about 6 weight percent zinc oxide;

from about 0.1 to about 1.5 weight percent fluorine; and

a balance of the glass fiber composition being silica.

2. The glass fiber composition of claim 1, wherein the boron is  
15 present as  $B_2O_3$ , alkali oxide is present as  $Na_2O$  or  $K_2O$ , and alkaline earth oxide  
is present as  $CaO$  or  $MgO$ .

3. The glass fiber composition of claim 1, wherein the alkali  
oxide is present as  $Na_2O$  and  $K_2O$  and alkaline earth oxide is present as  $CaO$  and  
20  $MgO$ .

4. The glass fiber composition of claim 1, further comprising  
less than about 0.2 weight percent of one or more compounds selected from  
the group consisting of  $MnO$ ,  $SrO$ ,  $Li_2O$ ,  $TiO_2$ ,  $ZrO_2$  and  $Fe_2O_3$ .

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5. A low-boron, high-barium filter comprising:

glass fibers comprising,

about 0 to 1 weight percent boric oxide;

from about 6 to about 16 weight percent barium oxide;

30 from about 10 to about 14.5 percent  $R_2O$ , wherein  $R_2O$  is a  
mixture of sodium oxide and potassium oxide;

from about 4 to 8 weight percent alumina;

from about 1 to about 9 weight percent calcium oxide and magnesium oxide;

from about 2 to about 6 weight percent zinc oxide;

from about 0.5 to about 1.5 weight percent fluorine;

5 a balance of the glass fibers being silica; and

wherein the glass fibers have an average diameter of from about

0.1  $\mu\text{m}$  to about 8.15  $\mu\text{m}$ .

6. The filter of claim 5, wherein the average diameter of the  
10 glass fibers is from about 0.1  $\mu\text{m}$  to about 3.0  $\mu\text{m}$ .

7. Low-boron, high-barium fine-diameter glass fibers comprising:

less than about 1 weight percent of  $\text{B}_2\text{O}_3$ ;

15 from about 5.5 to about 18 weight percent  $\text{BaO}$ ;

from about 10 to about 14.5 weight percent of  $\text{Na}_2\text{O}$  and  $\text{K}_2\text{O}$ ;

from about 4 to about 8 weight percent of  $\text{Al}_2\text{O}_3$ ;

from about 1 to about 9 weight percent  $\text{CaO}$  and  $\text{MgO}$ ;

from about 2 to about 6 weight percent  $\text{ZnO}$ ;

20 from about 0.1 to about 1.5 weight percent  $\text{F}_2$ ;

less than about 0.2 weight percent of  $\text{MnO}$ ,  $\text{SrO}$ ,  $\text{Li}_2\text{O}$ ,  $\text{TiO}_2$ ,  $\text{ZrO}_2$  and  $\text{Fe}_2\text{O}_3$ ; and

a balance of  $\text{SiO}_2$ .

25 8. The glass fibers of claim 7, wherein the glass fibers have an average diameter of from about 0.1  $\mu\text{m}$  to about 3.0  $\mu\text{m}$ .

9. A low-boron, high-barium glass fiber composition comprising:

less than about 1 weight percent of boric oxide;

30 from about 6 to about 16 weight percent barium oxide;

from about 10 to about 12.5 weight percent of alkali oxide;

from about 5 to about 6 weight percent of alumina oxide;

from about 1 to about 9 weight percent alkaline earth oxide;  
from about 2 to about 5 weight percent zinc oxide;  
from about 0.1 to about 1.0 weight percent fluorine; and  
a balance of the composition being silica.

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10. The glass fiber composition of claim 9, wherein the glass fiber composition forms glass fibers having an average diameter of from about 0.1  $\mu\text{m}$  to about 3.0  $\mu\text{m}$ .

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11. The glass fiber composition of claim 9, wherein boron is present as  $\text{B}_2\text{O}_3$ , alkali oxide is present as  $\text{Na}_2\text{O}$  and  $\text{K}_2\text{O}$ , and alkaline earth oxide is present as  $\text{CaO}$  and  $\text{MgO}$ .

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12. The glass fiber composition of claim 9, further comprising less than about 0.2 weight percent of one or more compounds selected from the group consisting of  $\text{MnO}$ ,  $\text{SrO}$ ,  $\text{Li}_2\text{O}$ ,  $\text{TiO}_2$ ,  $\text{ZrO}_2$ , and  $\text{Fe}_2\text{O}_3$ .

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13. A low-boron, high-barium glass fiber composition comprising:  
less than about 1 weight percent of boron;  
from about 6 to about 16 weight percent barium oxide;  
from about 10 to about 12.5 weight percent of alkali oxide;  
from about 5 to about 6 weight percent of alumina oxide;  
from about 1 to about 9 weight percent alkaline earth oxide;  
from about 2 to about 5 weight percent zinc oxide;  
from about 0.1 to about 1.0 weight percent fluorine;  
a balance of the composition being silica; and  
wherein the glass fiber composition forms glass fibers having an average diameter of from about 0.1  $\mu\text{m}$  to about 8.15  $\mu\text{m}$ .

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30 14. The glass fiber composition of claim 13, wherein the glass fibers have an average diameter of from about 0.1  $\mu\text{m}$  to about 3.0  $\mu\text{m}$ .

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15. A low-boron, high-barium HEPA or ULPA filter comprising:  
glass fibers comprising,  
less than about 1 weight percent of  $B_2O_3$ ;  
from about 6 to about 16 weight percent  $BaO$ ;  
5 from about 10 to about 12.5 weight percent of  $Na_2O$  and  $K_2O$ ;  
from about 5 to about 6 weight percent of  $Al_2O_3$ ;  
from about 1 to about 9 weight percent  $CaO$  and  $MgO$ ;  
from about 2 to about 5 weight percent  $ZnO$ ;  
from about 0.1 to about 1.0 weight percent  $F_2$ ;  
10 less than about 0.2 weight percent of  $MnO$ ,  $SrO$ ,  $Li_2O$ ,  $TiO_2$ ,  $ZrO_2$ ,  
and  $Fe_2O_3$ ;  
a balance of the filter being  $SiO_2$ ; and  
wherein the glass fibers have an average diameter of from about  
0.1  $\mu m$  to about 8.15  $\mu m$ .
- 15 16. The filter of claim 15, wherein the glass fibers have an  
average diameter of from about 0.1  $\mu m$  to about 3.0  $\mu m$ .
17. A method of making glass fibers for use in forming HEPA or  
20 ULPA glass filters having a low-boron concentration comprising:  
fiberizing a molten glass composition, wherein the glass  
composition comprises less than about 1 weight percent of boron, from about  
5.5 to about 18 weight percent barium oxide, from about 10 to about 14.5  
weight percent of alkali oxide, from about 4 to about 8 weight percent of  
25 alumina, from about 1 to about 9 weight percent alkaline earth oxide, from  
about 2 to about 6 weight percent zinc oxide, from about 0.1 to about 1.5  
weight percent fluorine, and a balance of the composition being silica;  
spinning the molten glass composition to produce glass fibers; and  
attenuating the glass fibers.

18. The method of claim 17, wherein the glass composition has boron present as  $B_2O_3$ , alkali oxide present as  $Na_2O$  and  $K_2O$ , and alkaline earth oxide present as  $CaO$  and  $MgO$ .

5 19. The method of claim 17, wherein the glass fibers are spun to have an average diameter of from about  $0.1 \mu m$  to about  $3.0 \mu m$ .